A FIELD GUIDE FOR

PUMPING TEST OPERATORS

(Small Production Wells for Community Water Systems)

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

April 2003

NHDES-WD-03-33

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

A FIELD GUIDE FOR PUMPING TEST OPERATORS

(Small Production Wells for Community Water Systems)

April 2003

Prepared by

The New Hampshire Department of Environmental Services
Water Division, Water Supply Engineering Bureau
6 Hazen Drive
Concord, N.H. 03301-0095
603-271-2947
http://www.des.nh.us.state/dwspp/newcomm.htm

Printed on Recycled Paper

Table of Contents

I. INTRODUCTION

Water falls from the atmosphere in either liquid or solid forms like rain or snow. When water reaches the ground it runs off into surface waters, evaporates back to the atmosphere, sinks into the ground, or is stored in ice or snow packs. All the water that exists on our globe is in one of these four places. Groundwater, the portion that sinks in, is either taken up by plants or stored in underground "reservoirs" called aquifers. Aquifers are not huge underground lakes and rivers as some believe. The water is really stored in the spaces between sand and gravel particles and in the cracks in bedrock.

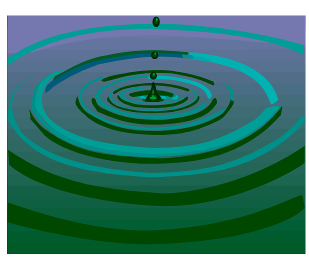
Water naturally moves very slowly underground. When a well is sunk in an aquifer and the pump turned on, water begins rushing towards the well. As pumping continues, water is drawn from farther and farther away. Eventually, the amount of water pumped from the well is greater than the volume of water stored in the aquifer and without recharge the well runs dry. Recharge is the water that is added to the stored water in an aquifer and comes from many sources, usually rain, snowmelt, surface water or another aquifer.

The volume pumped from the well is called discharge. When discharge is greater than recharge plus storage, an aquifer looks like a checking account on overdraft. Funds are being withdrawn faster than they are being deposited. The aquifer dewaters and the well runs dry. Too many wells in a single aquifer or too large a withdrawal from a single well or cluster of wells can tip the discharge/recharge balance into the red. A pumping test provides the needed information to keep withdrawals smaller than deposits and allows the aquifer account to stay in the black.

II. PURPOSE

As an extremely important part of the well siting process, pumping tests must be performed correctly, based on the requirements of New Hampshire Administrative Rules Env-Ws 378, *Site Selection of Small Production Wells for Community Water Systems.*

The purpose of the rules is to ensure that a small community water system can provide enough good quality water from its wells to meet a water system's needs. The pumping test provides the data needed to determine if a well can maintain a particular yield for long periods without rain, snowmelt or other recharge to the aquifer. DES created this guide as a tool for pumping test operators and applicants to better understand how to satisfy the pumping test requirements in the rules.



III. REQUIREMENTS OF ENV-WS 378

When an applicant chooses to site a new well, a preliminary report including site-specific information and a pumping test proposal with water quality analysis is submitted to DES. Upon approval of the preliminary report the pumping test and water quality analysis may be performed. The data gathered during the pumping test is evaluated and presented in the final report. Once all the required information is received and reviewed, DES either approves or denies the well siting application.

PLEASE NOTE: A temporary groundwater and or surface water discharge permit is required, even if pumping test water is not discharged to a stream. Contact Mitch Locker at 603-271-2858 for a permit application form. There is no application fee associated with a temporary discharge permit, and the application can usually be completed and received within 10 days.

Before Starting the Test

The pumping test operator should obtain a copy of the pumping test design if he did not propose the pumping test for the approved preliminary report. The design contains very important information the operator needs to know <u>before</u> beginning the test. It contains the proposed pumping rates for all wells being tested. This helps size the pumps and inline flow meters. It also tells if other wells or surface waters need to be monitored during the test. It documents the type of water level monitoring equipment that should be used and how often water level measurements must be taken. The design also describes water quality sampling, frequency of sampling, parameters to be sampled, which lab is being used, and whether the operator or the consultant is expected to collect the samples.

If no pumping test design is available, be sure to ask the client if this is a community water supply well and remind the client that community water supply wells must be approved by the state.

Large single family home developments (greater than 10 houses), condos, apartment complexes, mobile home parks, schools with dorms, and large vacant acreage that could be subdivided into several house lots are examples of existing and potential housing that might use a community water supply system and require approval from DES.

A. SETUP

Try to set up all pumps, plumbing, hoses, and other equipment a day in advance so any joint compounds, or other materials, are dry and not affect water quality results. This also allows the operator to check all equipment prior to the test to make sure it works. Delays in starting the test can cause a huge ripple effect that can cost the operator and the client time and money. Lab tests may need to be rescheduled, the consultant may have to spend more days in the field than budgeted for, or the operator's time may be wasted chasing down replacement equipment. If equipment is not tested in advance and failure occurs once the test has started, the test may be canceled, causing problems for both the operator and the client.

The equipment attached to the discharge line should include an inline meter, a valve to control flow, a sampling tap for water quality samples, and a separate tube down the well for ease and accuracy of water level measurements.

1. Pump

The pump and electrical service to the pump must be able to run the entire length of the test without stopping. The pump should be sized correctly to pump at the rate designated in the proposed pumping test design. It should be located above a water-bearing fracture in the well so that water flows upward over the pump, cooling it. Three-phase wiring is recommended.

If using a portable generator, make sure there is enough fuel on hand to run it for the whole test. If it is necessary to leave the test site for any reason, make sure the generator is gassed up before leaving. Back up equipment should be on site or readily available in case of failure. A long time spent searching for back-up equipment may result in repeating the pumping test.

2. Discharge Setup and Location

The discharge pipe should be equipped with a gate valve or similar device to regulate and maintain a constant discharge rate. An inline flow meter must be used to determine the rate. A bucket and stopwatch is not acceptable for measuring the discharge rate, though this method may be used as a rough check of the meter accuracy.

A water quality sampling tap is advised. Locate the tap where it is least likely to be affected by turbulence in the pipe. Some of the sample bottles are small and require a slight but steady flow to fill. Make sure that the type of tap installed is capable of delivering this kind of flow. Water quality testing is very expensive and a sampling tap helps keep the water samples clean. Do not take water quality samples from the end of the discharge hose.

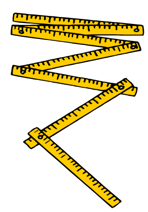
The discharge line must be long enough to discharge the pumped water where it will not affect the aquifer's response to pumping. A good rule of thumb is at least the length of the sanitary protective area radius, but it may need to be longer depending upon site conditions. For instance, bedrock outcrops or coarse sand and gravel might cause water to flow in a direction that affects aquifer hydraulics and the pumping test.

Water should easily flow away from the well site. Look for natural drainage areas to locate the discharge outlet. Care should be taken so that the discharged water will not cause erosion or scouring at the discharge point. Make sure to bring extra lengths of discharge line to the site in case the discharge location must be changed. Have at least 1000 feet of hose available. DES personnel may require the operator to move or extend the line, or ponding or some other problem may occur during the test. For example, the well is located in a low spot. The 200-foot discharge line dumps the water uphill, but it just runs back down towards the wellhead, puddling there. In this situation, add more lengths onto the discharge line until the water flows down the other side of the hill and away from the well. Monitor the discharge location periodically during the test to make sure no ponding occurs. Check for leaks in the line and fix them.

Wetlands, flat terrain, sandy soil, and an urban setting all offer challenges when choosing a discharge location where the discharged water will not affect pumping test hydraulics. Most wetlands have a natural or man-made outlet. Try to set the discharge as close to this outlet as possible. Add on extra discharge hose if necessary. Nowhere in New Hampshire is totally flat. Search out natural drainage areas and use them. Add on extra hose if necessary. Sandy soils can potentially route discharge water rapidly back to the well. In this situation as much as 1,000 feet or more of discharge line may be necessary.

Urban settings pose different kinds of problems. Do not discharge pumping test water to storm drains or roadside ditches without permission from the regulating agency. The N.H. Department of Transportation frowns on discharging anything other than storm water onto state rights of way. Also be careful not to flood neighboring lots. This situation requires a delicate balancing act of choosing a location far enough away to not affect test hydraulics, but not so far as to impact neighboring lots.

If discharging the pumped water back into the water system's storage tanks, obtain permission from DES's Water Supply Engineering Bureau to do so. Contact Jim Gill at 603-271-2949 for further information. Please note, a flow meter, sampling tap and a method for controlling the flow rate on the discharge line is still necessary.



3. Water Level Measurement Equipment

Water levels must be measured with a device capable of reading to less than an inch. The reason for this is that DES defines stabilization as a water level that varies less than an inch in two hours for a 12-hour period. This means that for the entire 12 hours the water level cannot change more than an inch per each two-hour block of time. Electronic measurement equipment should be used. Make sure all personnel know how to read the tape on the electronic probe before starting the test. Some tapes read in inches, others in 10^{ths} of a foot. Some equipment reads in both scales, one on either side of the tape. Know the equipment! Remember, water levels must be read and recorded at less than an inch. One inch equals .083 feet, so if an electronic tape is calibrated in 10^{ths} of a foot the operator needs to be able to determine a variation of .08 feet. This means reading the tape to the nearest 100^{th} of a foot.

Pressure transducers with dataloggers may be used, but should be checked often to avoid having to restart or repeat the test in case of a failure. Beware! These devices may appear to be recording water levels, but when downloaded the data is absent. If unfamiliar with dataloggers, make sure to get some training on setting up and running one.

To avoid getting the probe stuck in the well, a separate tube should be used. Faulty readings can also result from water cascading down from fractures above the water level in the well and turbulence from the pump. Be careful when choosing PVC pipe for the measurement tube. Some is coated with a resin that contaminates the water sample. Make sure the diameter of the tube is large enough to accommodate the probe. One inch is usually large enough. Each well being tested should, ideally, have its own monitoring device. Completely removing the tape from the well each time a measurement is taken can cause the tape to kink, giving inaccurate readings. Back up equipment should be on site, or readily available to avoid having to restart or repeat the test in case of a failure.

B. DISCHARGE

1. Constant Rate

The new well and all other wells needed to meet the system’s source capacity requirements must be pumped together at a constant rate. System source capacity should be listed in the pumping test design submitted with the preliminary application. New wells must be pumped at their proposed permitted production volume (PPV). Existing wells should be pumped at either their PPV or the volume needed to supply the system, even if that means discharging excess water onto the ground. The pumping rates for all wells should be outlined in the pumping test design. New wells may be pumped at volumes greater than the PPV as long as the total rate for all new wells does not equal 40 gallons per minute (gpm), or a volume of 57,600 gallons over any 24-hour period. Wells that pump more than 40 gpm are regulated by rules requiring more technical analysis and involve longer, more sophisticated pumping tests. Divide PPV by 1,440 minutes to get the discharge rate.

Changing the pumping rate during the test causes water levels in the well to jump around. The consultant uses these water levels to tell how the aquifer reacts when pumped. Changing the pumping rate clouds this picture, making it hard to assess aquifer conditions.

If the system’s other wells are not needed to meet the system's source capacity, they should either be shut down for the entire test or run at a constant rate. When the pumps cycle on and off supplying water to the system, they can cause water levels in the wells being tested to jump around and a stable water level cannot be reached. However, if the existing wells are far enough away to not affect water levels in the wells being tested, at least 1,000 ft., they do not need to be shut down during the test.

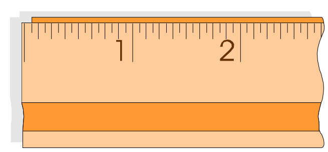
2. Measuring Discharge

The pumping rate may not change more than +/- 5 percent after the first six hours of pumping. For a 10 gpm well this means +/- ½ gpm, +/- 1 gpm for a 20-gpm well, and +/- 2 gpm for a 40 gpm well. Discharge must be measured with a device that can give this kind of accuracy. The apparatus favored by most operators is an inline water meter or the equivalent.

Discharge measurements must be taken every 15 minutes for the first 2 hours and at least once every hour after that. Many operators fail to take this measurement often enough.

Some meters read in gallons only, others in gallons per minute (gpm), and some may even read in cubic feet per second. Know the equipment! If a device reads in gallons only, usually a cumulative meter, the operator will need to determine gpm. The best method for doing this is to take two readings one minute apart and subtract the smaller reading from the larger one. Do this several times and average the results.

Please note that a single new well pumping greater than 40 gpm or a group of new wells with a combined rate greater than 40 gpm are considered large wells and fall under the requirements of Env-Ws 379, *Site Selection of Large Production Wells for Community Water Systems* and Env-Ws 387 & 388, *Large Groundwater Withdrawal Permitting.*



C. WATER LEVEL MEASUREMENTS

1. Frequency

Record water level measurements in feet, inches and fractions of an inch, or in feet, 10ths and 100ths of a foot. Record the elapsed time in minutes from the start of the test. Enter both on a well log sheet. A sample sheet can be found in Appendix A. Feel free to photocopy it. Each well should have its own log sheet. Putting several columns for water levels on one sheet opens the door to making mistakes. It is very easy to record a water level in the wrong column.

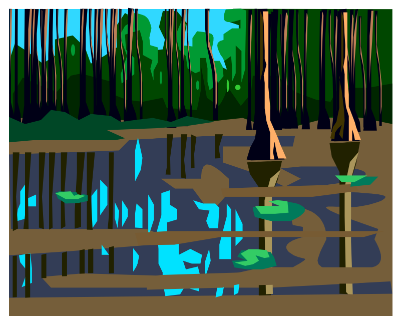
The pump should have been off for at least 24 hours before starting the test. This allows the well to fully recover if the pump was tested during setup. Record the static water level just before starting the pump. Do not record the static water level earlier. Atmospheric pressure can affect water levels in non-pumping wells, so the static water level today is apt to differ from yesterday's. Measure and record water levels every 5 minutes for the first hour of pumping. This may require some scrambling if several wells are being tested at once. Consider using extra helpers for the first hour, especially if testing more than one well.

After the first hour of testing, water levels must be taken at least every hour or at the frequency that was proposed in the approved pumping test design. If the person who designed the pumping test is not present during the test, the operator should have a copy of the pumping test design as approved in the preliminary report before beginning the test. Do not start the pumping test without knowing how it was proposed in the preliminary report.

2. Accuracy And Equipment

Water levels must be recorded in fractions of an inch or 100$^{\text{ths}}$ of a foot. Use water level measurement equipment that can measure to less than an inch. DES recommends electronic equipment, but a tape and plopper is acceptable for shallow wells other than the production well. When using a tape and plopper be careful not to tangle it in the pump wires. If several wells are being tested, an electronic device might make taking measurements easier and faster.

If a metal tape and plopper is used, always mark the tape with blue carpenter's chalk. Take at least three readings for each measurement and average them. Dry and rechalk the tape between each reading. Read the tape to fractions of an inch.



3. Other Water Level Measurements

If there is any surface water body four acres or smaller within 150 feet of the well(s), water levels must be measured there also. Using a staff gauge or similar device, take readings before pumping starts and every 12 hours thereafter. The measurement device should be affixed to a stake driven into the bottom the surface water body. Be sure the calibrated side of the device is facing the bank.

Also monitor the water levels in any private wells within 500 feet of the production well, if possible. One reason for this requirement is a liability issue. In the past, DES has received complaints from neighboring well owners that the production well affected their water supply. If the domestic source was not monitored during testing, no data exists to prove otherwise.

If a homeowner refuses access to a well for monitoring, document that fact. Note the date the person was contacted, their name and address, and that they did not allow access to the well site. If they give a reason, note that also. Though the operator is not obligated to have them sign a release, he may wish to do so.

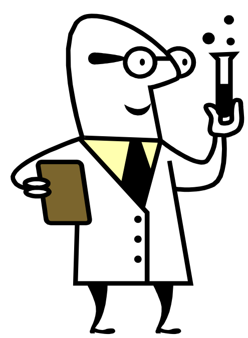
4. Weather Conditions

Precipitation data must be collected for one week prior to testing. Also, the operator must record on the log sheet all rain or snow events and other weather conditions at least twice daily throughout the testing and recovery period. Try to measure rainfall amounts using a rain gauge. Also make notes describing the intensity, frequency and duration of all rain events.

D. Troubleshooting the Pumping Test

Things can go wrong in a pumping test and frequently do. If water levels are dropping too fast and dewatering appears likely, throttle back the pumping rate. Do not wait until water levels drop to the elevation of the pump before taking action. If anything must be changed during the test, remember that at least 12 hours of pumping at a constant rate is needed to determine stabilization. **Note all changes made during the test on the log sheet.**

The test may run the entire 48 hours and not reach stabilization. If water levels do not meet the "less than an inch in any two-hour period" definition of stabilization at the end of 48 hours, either reduce the rate and continue pumping until stabilization is reached, or determine if the 180-day water level meets stabilization requirements as defined by Env-Ws 378. See Appendix B for an explanation of how to determine the 180-day water level.



E. WATER QUALITY SAMPLING

1. Timing

Unless proposed differently in the pumping test design, the water samples must be taken right at the end of the test before shutting down the pump. A full Safe Drinking Water Act (SDWA) analysis must be done. A listing of the parameters for that analysis can be found in Appendix C. If using the DES laboratory for the analyses, schedule the tests in advance. Be sure to coordinate the laboratory sample analysis with the timing of the pumping test. Call the DES lab at 603-271-3445 or 3446. Commercial labs may also require scheduling of the tests. Make sure to check with any lab before assuming they will accept or be able to process the samples within the holding time.

2. Lab

The laboratory chosen must be accredited by the State of New Hampshire for all drinking water categories being tested, use approved methods, and be able to meet required detection limits. A list of labs and the parameters they are accredited to analyze can be found at http://www.des.st.nh.us/asp/NHELAP/lablist.asp.

3. Collection and Delivery

Be very careful when collecting water samples and use a sampling tap. This will help ensure the sample is not contaminated during the collection process. If possible, wear latex gloves and avoid touching the insides of both the sample bottles and their caps. Directions for taking water samples can be found in Appendix C. Any contamination introduced into a water sample will make it useless, and additional testing will have to be performed. The client will have to pay for another test. The full range of testing for SDWA costs over $1,000 for just one well. Also, store the samples in a cooler with ice while transporting them to the lab. The DES lab will measure the temperature of the samples when they arrive and reject any sample warmer than 50 degrees F.

Samples must reach the DES lab within 24 hours of being taken. If using a private lab, check with them to determine the holding time for a sample before they reject it.

F. DURATION

A small production well pumping test must be run for at least 48 hours. A pumping test can be stopped after 48 hours only if stabilization has occurred. See Section A3 for a definition of stabilization. DES urges the pumping test operator to contact the person who designed the pumping test before shutting down a test for a well in which a water level has not stabilized. DES may also be contacted for advice.

For Further Information:

Website: **www.des.state.nh.us/dwspp/newcomm.htm**

Call: **603-271-2947**

V. Terms and Abbreviations Used in This Document

Antecedent Period- A seven-day period just before the start of the test when the well is not pumped.

Aquifer- An underground water-bearing geologic formation.

Confined Conditions- Situation when an aquifer is bounded on the top by some layer like clay that keeps water from moving freely through it. A flowing well often shows this condition.

Datalogger- A computerized electronic device that automatically records water levels.

EPA- the United States Environmental Protection Agency

Env-Ws 378- The Administrative Rules regulating the siting of wells pumping at a rate less than 40 gpm for community water systems. (Small wells.)

Env-Ws 379- The Administrative Rules regulating the siting of wells pumping at a rate greater than 40 gpm for community water systems. (Large wells.)

DES-New Hampshire Department of Environmental Services

Permitted Production Volume (PPV)- The maximum volume of water permitted by DES that may be withdrawn from the well in any 24-hour period.

Preliminary Report- Report submitted to DES by the applicant or consultant that outlines how the pumping test will be operated.

Private Wells-Those not owned by the system being tested.

Pumping Period- That length of time when the well is tested at a constant pumping rate.

Recovery Period- The length of time just after the pump is shut down when the well recovers from pumping.

SDWA- Safe Drinking Water Act

SOC- Synthetic organic compounds, primarily those chemicals used as pesticides and herbicides.

Surface Water- Any body of stand or flowing water, such as a lake, pond, stream or wetland.

VOC- Volatile organic compounds, primarily but not exclusively those chemicals derived from petroleum products, such as paint thinners, gas additives and degreasers.

Appendix A

Example of a Pumping Test Log

Water System Name:_____________________________________EPA ID#:________________________

Description of Well Location:____

Well Depth:________________Depth of Pump Intake/Screen: _________________________________

Reference Point Used to Measure Depths:____

Test Performer Name:____

Date Test Started:__________________________ Static (No Pumping) Water Level:_______________

Day/Time	Elapsed Time	Depth to Water	Pumping Rate	Comments/Weather

Appendix B

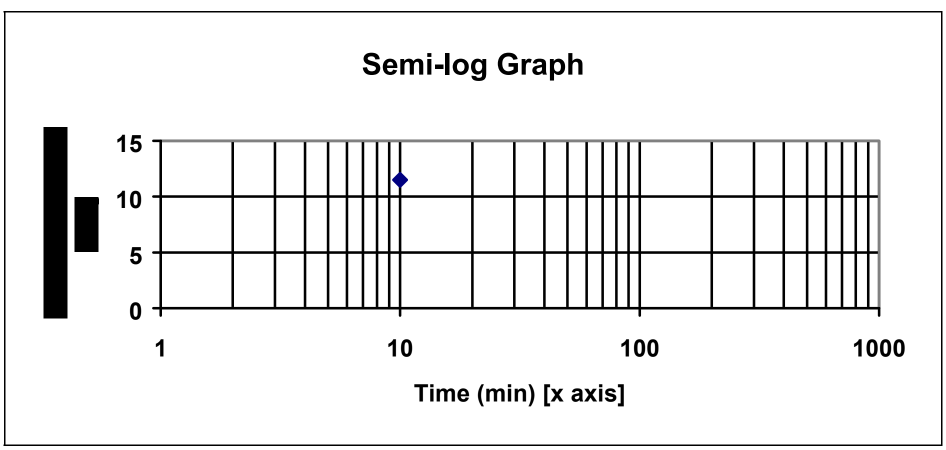
Guide for Creating a 180-Day Time Drawdown Chart

The criterion for ending a pumping test after 48 hours is stabilization. The primary method for determining stabilization is reaching a water level that varies no more than one inch in two hours for a 12-hour period. Often a pumping test will not reach stabilization by this method.

Another method for determining stabilization is the 180-day time drawdown chart. This is a semi-logarithmic graph that estimates what the water level in the well would be at 180 days if the drawdown trend at the end of the pumping test continued the same. It assumes a constant pumping rate for 180 days with no recharge and water level variation that does not change after 48 hours. If the resulting estimated water level is more than five feet above the level of the pump, there should be enough water available for the system's needs.

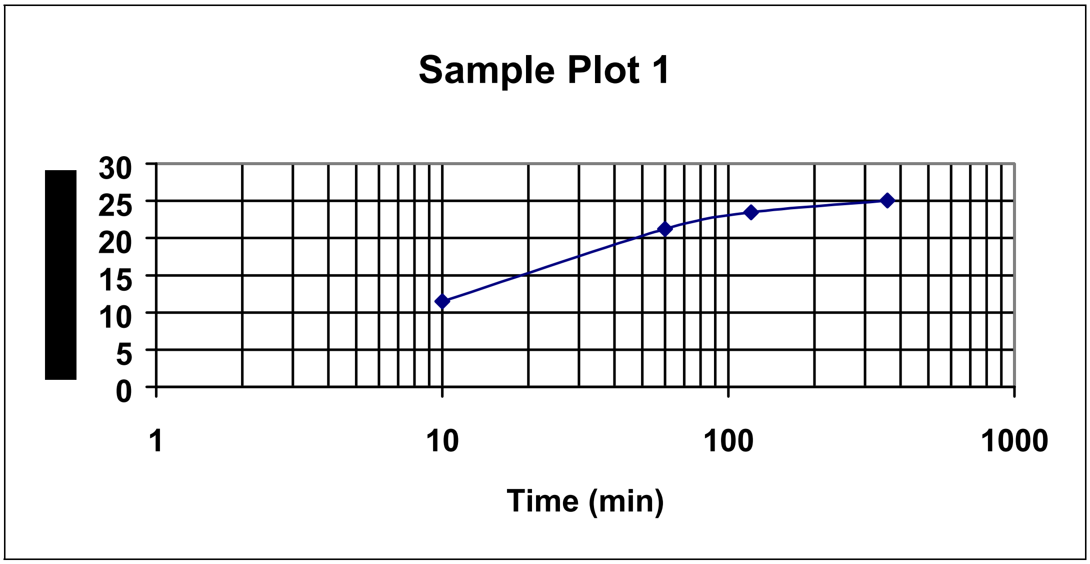
Begin by recording the pumping test water level measurements and the elapsed times at which the measurements were taken. These data points will be graphed on a semi-logarithmic plot. A semi-log plot has one axis in logarithmic scale and the other in normal scale. Each increment on a logarithmic axis is 10 times the previous one. For example, a log axis with a maximum of 1,000 would have the increments 1, 10, 100 and 1000. (See the semi-log graph below.) Plot the data on semi-log graph paper or by computer. Directions for creating a semi-log plot in *MS Excel* can be found at the end of this document.

When creating the plot, time in minutes should be graphed on the logarithmic scale axis (usually the x axis) and drawdown in feet on the normal scale axis (usually the y axis). Mark the points on the graph by matching the drawdown measurement on the y axis to the elapsed time on the x axis. For example, the graph below shows one measurement of 11.51 ft. taken at 10 minutes into the test.

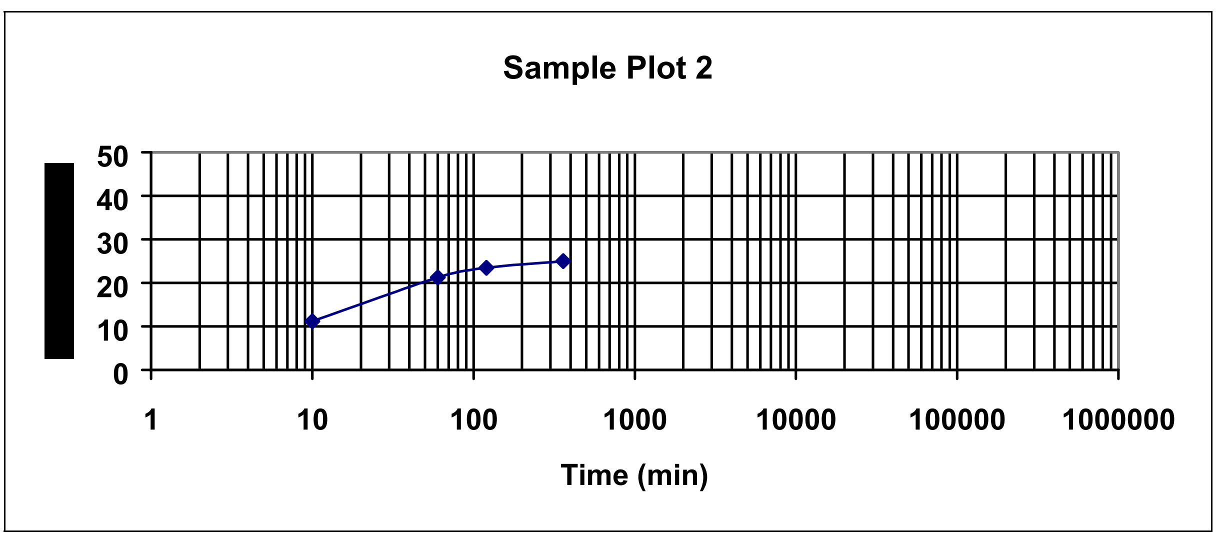


The rest of the measurements are then plotted the same way. Sample Plot 1 employs the data points listed in the table below. For simplicity, only four drawdown measurements are plotted. Use all the measurements taken during the pumping test.

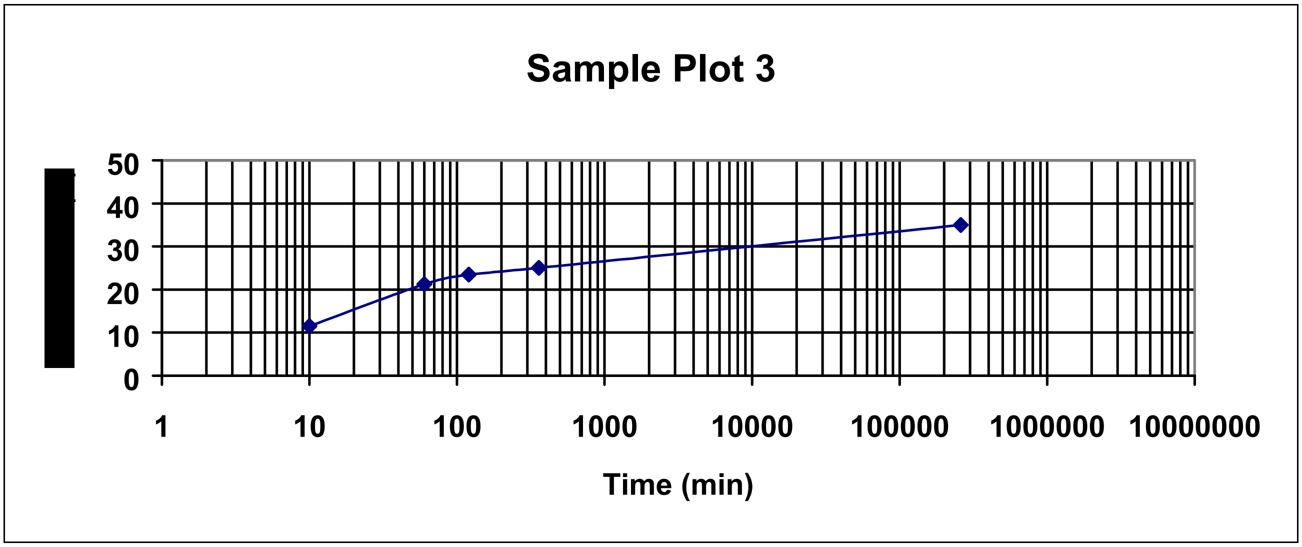
<u>Time(min)</u>	<u>Drawdown(ft)</u>
10	11.51
60	21.24
120	23.46
360	25.03



Now extend the time axis out to 180 days, or 259,200 minutes and the drawdown axis to 20 or 30 feet more than the largest drawdown measurement, as in Sample Plot 2.



Draw a best-fit line by laying a ruler along the data points taken from the last 12 hours of the test and marking a straight line through them. Extend the straight line out to the180 day point, or 259,200 minutes, as shown in Sample Plot 3.



Read the drawdown at 180 days from the chart. In this instance that water level is 35 feet. If the estimated water level at 180 days is at least five feet above the elevation of the pump, then there should be enough water for the system's needs. If this water level is below the pump, either lower the final elevation of the pump or continue the pumping test, using a slower pumping rate. After at least 12 hours of pumping at a constant rate, repeat the process above if stabilization is not reached by the primary method.

Creating A Semi-Log Plot in *MS Excel*

Step 1. Plot the data in two columns in an *MS Excel* spreadsheet. Head the columns with the titles of the x and y axes. Then highlight both columns including the headers.

Step 2. Click on “Insert” and then “Chart.”

Step 3. Choose “xy (scatter).”

Step 4. Choose the style you want by clicking on the appropriate box.

Step 5. Click “next” twice.

Step 6. Fill in the appropriate boxes for all the tabs. Check major and minor gridlines on the x axis values section of the gridlines tab. If plotting pumping test results for only one well, uncheck the “show legend” box on the legend tab.

Step 7. Click “next.”

Step 8. Click “finish.”

Step 9. Move the chart to its final location by clicking on it until the corner boxes show, then drag the chart into position.

Step 10. Right click on the x-axis data numbers.

Step 11. Choose “format axis” from the pop-up menu.

Step 12. Click the “scale” tab and click in the box labeled “logarithmic scale” at the bottom of the window. Change the maximum scale to 1,000,000. If necessary, change the ‘major’ and ‘minor unit’ to 10.

Appendix C

Guidance for Conducting and Reporting SDWA Analyses For New Community Wells and Groundwater Sources of Bottled Water

The following parameters are required for water quality analysis of a new drinking water source for a community water supply system or source of bottled water. This guidance will be updated periodically. The applicant is responsible for obtaining and using up-to-date information. Contact DES at (603) 271-2947 with questions and for the most recent guidance.

The laboratory must: apply EPA approved drinking water methods.
have current drinking water certification for all analyses.
identify all subcontracted analyses, laboratories and their certification.

Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
E. Coli	Bio	Absent	
Fecal Coliform	Bio	Absent	
Total Coliform	Bio	Absent	
Alkalinity	IOC	n.e.	
Specific Conductance	IOC	n.e.	
Arsenic	IOC	0.01	0.005
Aluminum[d]	IOC	0.05[d]	0.05
Barium	IOC	2.0	1.0
Cadmium	IOC	0.005	0.0025
Chloride[d]	IOC	250[d]	250
Chromium	IOC	0.1	0.05
Copper[c]	IOC	90% of trigger	1.3
Cyanide (as free C)	IOC	0.2	0.1
Fluoride[a, d]	IOC	4.0 [a]	2.0
	IOC	2.0 [d]	1.0
Iron[d]	IOC	0.3[d]	0.3
Lead[c]	IOC	90% of trigger	0.015
Manganese[d]	IOC	0.05[d]	0.05
Mercury	IOC	0.002	0.001
Nickel	IOC	0.1	0.05
Nitrate (as N)	IOC	10.0	5
Nitrite (as N)	IOC	1.0	.5
Selenium	IOC	0.05	0.025
Silver[d]	IOC	0.10[d]	0.05
Sodium[d]	IOC	100-250[d]	250
Sulfate[d]	IOCU	250[d]	125

Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
Sulfide[d]	IOC	0.05[d]	0.025
Antimony	IOC	0.006	0.003
Beryllium	IOC	0.004	0.002
Thallium	IOC	0.002	0.001
Zinc[d]	IOC	5[d]	2.5
Tot. Hard.($CaC0_3$) [d]	IOC	n.e.	
Calcium Hardness [d]	IOC	n.e.	
pH[d]	IOC	6.5-8.5[d]	6.5-8.5
Uranium (Mass)	Rad	n.e. (ug/L)	
Radium 226 & 228	Rad	5 piC/l	
Screen Alpha (Gross Alpha) [e]	Rad	n.e.	
Radon Gas	Rad	n.e.	
Adjusted Gross Alpha (Gross Alpha Minus Uranium)	Rad	15 piC/l	
Endrin	SOC	0.002	If Detected
Lindane	SOC	0.0002	If Detected
Methoxychlor (DMDT, Martate)	SOC	0.04	If Detected
Toxaphene	SOC	0.003	If Detected
Carbaryl	SOCU	n.e.	
Methomyl	SOCU	n.e.	
Glyphosate	SOC	0.7	If Detected
Di(2-ethylhexyl)adipate	SOC	0.4	If Detected
Oxamyl (Vydate)	SOC	0.2	If

			Detected
Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
Simazine	SOC	0.004	If Detected
Di(2-ethylhexyl)phthalate	SOC	0.006	If Detected
Picloram	SOC	0.5	If Detected
Dinoseb	SOC	0.007	If Detected
Hexachlorocyclopentadiene	SOC	0.05	If Detected
Aldicarb sulfoxide	SOC	0.004	If Detected
Aldicarb sulfone (aldoxy carb)	SOC	0.002	If Detected
Metolachlor	SOCU	n.e.	If Detected
Carbofuran (Furadon, 4F)	SOC	0.04	If Detected
Aldicarb (Temik)	SOCU	0.003	If Detected
Atrazine (Atranx, Crisazina)	SOC	0.003	If Detected
Alachlor (Lasso)	SOC	0.002	If Detected
Heptachlor	SOC	0.0004	
3-Hydroxycarbofuran	SOCU	n.e.	If Detected
Heptachlor epoxide	SOC	0.0002	
Dieldrin	SOCU	n.e.	
Butachlor	SOCU	n.e.	
Propachlor	SOCU	n.e.	
2,4-D	SOC	0.07	If Detected
2,4,5 TP (Silvex)	SOC	0.05	If Detected
Hexachlorobenzene	SOC	0.001	If Detected
Benzo (a) pyrene (PAHs)	SOC	0.0002	If Detected
Pentachlorophenol	SOC	0.001	If Detected
Aldrin	SOCU	n.e.	
Dicamba	SOCU	n.e.	
Metribuzin	SOCU	n.e.	
Chlordane	SOC	0.002	If Detected

Chloromethane	VOCU	n.e.	
Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
Bromomethane	VOCU	n.e.	
Chloroethane	VOCU	n.e.	
Methyl tertiary-butyl ether (MtBE) [g,d]	VOC	0.020[g]	0.013[g]
	VOC	0.013 [d]	If Detected
Tertiary amyl methyl ether (TAME) [e] (2-methoxy-2-methylbutane)	VOCU	n.e.	If Detected
Tertiary butyl alcohol (TBA) [e]	VOCU	n.e.	If Detected
Ethyl tertiary butyl ether (ETBE) [e]	VOCU	n.e.	If Detected
Di-isopropyl ether (DIPE)[e]	VOCU	n.e.	If Detected
1,2,4-Trichlorobenzene	VOC	0.07	If Detected
1,2-Dichloroethylene (cis)	VOC	0.07	If Detected
1,1-Dichloropropene	VOCU	n.e.	
1,3-Dichloropropane	VOCU	n.e.	
1,3-Dichloropropene (cis)	VOCU	n.e.	
1,2,3-Trichloropropane	VOCU	n.e.	
2,2-Dichloropropane	VOCU	n.e.	
Chloroform[f]	VOCU	n.e.[f]	
Bromoform[f]	VOCU	n.e. [f]	
Bromodichloromethane[f]	VOCU	n.e. [f]	
Chlorodibromomethane[f]	VOCU	n.e. [f]	
Xylene (total)	VOC	10.0	If Detected
Dichloromethane (methylene chloride)	VOC	0.005	If Detected
o-Chlorotoluene	VOCU	n.e.	
p-Chlorotoluene	VOCU	n.e.	
1,3-Dichlorobenzene (m-Dichlorobenzene)	VOCU	n.e.	
1,2 Dichlorobenzene (o)	VOC	0.6	If Detected
1,4 Dichlorobenzene (para)	VOC	0.075	If Detected
Vinyl chloride	VOC	0.002	If detected
1,1-Dichloroethylene	VOC	0.007	If Detected

1,1-Dichloroethane	VOCU	n.e.	
1,2-Dichloroethylene (trans)	VOC	0.1	If Detected
Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
1,2 Dichloroethane	VOC	0.005	If Detected
1,1,1-Trichloroethane	VOC	0.200	If Detected
Carbon tetrachloride	VOC	0.005	If Detected
1,2-Dichloropropane	VOC	0.005	If Detected
Trichloroethylene	VOC	0.005	If Detected
1,1,2-Trichloroethane	VOC	0.005	If Detected
1,1,1,2-Tetrachoroethane	VOCU	n.e.	

Parameter	**Group**	**MCL (mg/l)**	**Trigger (mg/l)**
Tetrachloroethylene	VOC	0.005	If Detected
1,1,2,2 Tetrachloroethane	VOCU	n.e.	
Monochlorobenzene (Chlorobenzene)	VOC	0.1	If Detected
Benzene	VOC	0.005	If Detected
Toluene	VOC	1.0	If Detected
Ethylbenzene	VOC	0.7	If Detected
Bromobenzene	VOCU	n.e.	
Styrene	VOC	0.1	If Detected

Abbreviations:

MCL- The Maximum Contaminant Level allowed in drinking water
SDWIS – Safe Drinking Water Information System
Bio - biological
Rad - radiological parameter
IOC - inorganic parameter/compound
SOC - synthetic organic compound
SOCU - synthetic organic compound unregulated
VOC - volatile organic compound
VOCU - volatile organic compound unregulated
n.e. - not established: reporting is required

Footnotes:

[a]Fluoride has a secondary MCL of 2.0 mg/L, and a primary MCL of 4.0 mg/L
[b]pH is expressed in units of hydrogen ion activity
[c]Lead and Copper samples are collected in tap water samples throughout the distribution system
[d]Aesthetic Regulated Secondary MCLs
[e]Recommended additional reporting parameters
[f]Total MCLs combined equals 0.100
[g]MtBE has a secondary MCL of 0.020 mg/L and a primary MCL of 0.013 mg/L

How to Take Water Quality Samples During Pumping Tests

This form describes the different bottles used for an initial water quality sampling of new community water supply wells. Samples should be taken at a sampling tap installed in the discharge pipe. Please read this information carefully since some of the bottles contain preservatives, which should not come in contact with eyes or skin. Keep in mind that the bottle descriptions are for bottles used by the New Hampshire Department of Environmental Services (DES) lab; other labs may use different bottles. Please call the DES Lab at 603-271-3445 with questions about how to take these samples. Hold times for the samples vary from as soon as possible to six months, depending on the test.

**All samples must be kept on ice. Ice packs will not keep them cold enough.
The DES lab will reject all samples warmer than 50°F.**

IOC Sampling

Bottles used: 1 round plastic 125 mL bottle for bacteria.
1 square, 500 mL pre-cleaned bottle for metals.
1 pear shaped, 100 mL bottle for cyanide.
1 oblong shaped, 500 mL bottle for anions, alkalinity, and pH.

Preservatives in bottles: 5 mL of concentrated nitric acid added to metals container;
3 pellets of sodium hydroxide to cyanide container;
no preservative in anion container,
1 sodium thiosulphate pellet added to bacteria container.

Procedure for filling bottles: Turn on sampling tap and run water for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that the stream of water is no greater than 1/8 inch in diameter. Remove container caps. Do not put caps face down or in pocket. Do not allow inside of caps, inside of container or bottle threads to be touched by any object. Use caution when filling these bottles. The square bottle contains acid. As the water comes in contact with the acid a white cloud will drift from the bottle. This is normal. Do not put your face within the cloud or inhale the fumes. Fill bottles to shoulder. Do not overflow. Screw caps on securely.

Nitrate and/or Nitrite Sampling

Bottle used: Pre cleaned plastic or glass bottle (usually 40 mL), yellow cap.

Preservatives in bottle: None

Procedure for filling bottle: Same procedure as IOC sampling.

Radiological Sampling

Bottles Used: 1 pre-cleaned 1-gallon plastic bottle and 1 40 mL glass vial with Teflon septa.

Preservatives in Bottles: There are no preservatives in either bottle.

Procedure for filling bottles: Same procedure as IOC sampling.

SOC Sampling:

(Please note, if using the DES Lab, SOC samples must be scheduled prior to collection. Call the lab at 603-271-3445 for an appointment. If using a private lab, call in advance for their policies regarding the scheduling of tests.)

Bottles used: 2 pre-cleaned one-liter amber glass bottles with Teflon-lined caps.
6 pre-cleaned 40 mL glass vials with Teflon-lined caps.

Preservatives in Bottles: Both types of bottles contain chemical preservatives. Use caution when taking samples.

Procedure for filling bottles: Turn on sampling tap and run for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter.

For each one-liter bottle: Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object. Do not rinse bottle. Use caution when filling these bottles, open them slowly and carefully to avoid acid burns. Fill to shoulder of the bottle. Screw on cap securely.

For each of the 40 mL vials: Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside or vial or bottle threads to be touched by any object. Use caution when filling these bottles, open them slowly and carefully to avoid chemical burns. Do not rinse vial. Fill vial to the top creating a crown but do not overflow due to the preservative. Screw on cap securely. Check for air bubbles by inverting the vial and gently tapping the cap. If bubbles are present, add additional water.

VOC-MTBE-TTHM and HAAS:

Bottle used: 2 pre-cleaned 40 mL glass septum vials with Teflon septa each sample site.

Preservatives in Bottles: 0.25 mL of 1:1 Hydrochloric acid.

Procedure for Filling Bottles: Turn on sampling tap and run for four to five minutes or until the water temperature has stabilized, whichever is longer. Then reduce flow so that stream of water is no greater than 1/8 inch in diameter. Remove container cap. Do not put cap face down or in pocket. Do not allow inside of cap, inside of bottle or bottle threads to be touched by any object. Do not rinse bottle. Use caution when filling these bottles, open them slowly and carefully to avoid acid burns. Fill to the top, creating a crown, but do not overflow due to preservatives in the bottle. Screw on cap securely. Check for air bubbles by inverting the vial and gently tapping the cap. If bubbles are present, add additional water.